A Comparative Study of Spatial Decoding Methods for Binaural Renderings in 3D Audio

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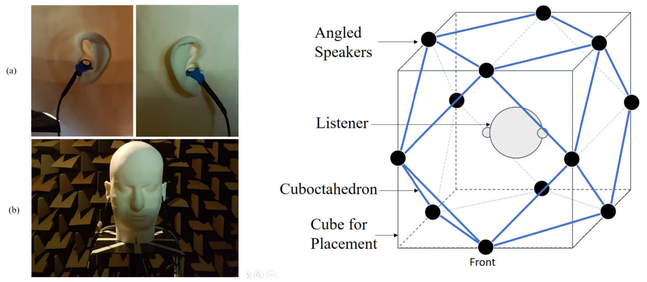
Summary

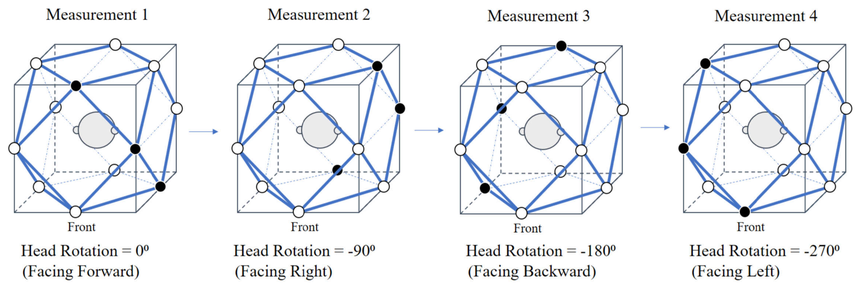
- Binaural room impulse responses were measured using a 3D printed dummy head. Room responses were measured at the same position using first-order Ambisonics (B-format) AMBEO mic.
- HRTFs of the same dummy head were measured from 12 positions to form 12 virtual speakers.
- Mapping of B-format signals to virtual speakers were done using ALLRAD decoder and Spatial Decomposition Method (SDM) to get Binaural Rendered Room impulse responses.
- Listening tests were carried out where the rendered binaural room impulse responses were compared to recorded binaural room impulse responses by convolving with dry audio. Listeners were asked to judge the similarity of the rendering techniques to recordings.

Methodology – Binaural Recording

- A dummy head was 3D printed from the FABIAN database
- HRTFs were (re)measured in an anechoic chamber

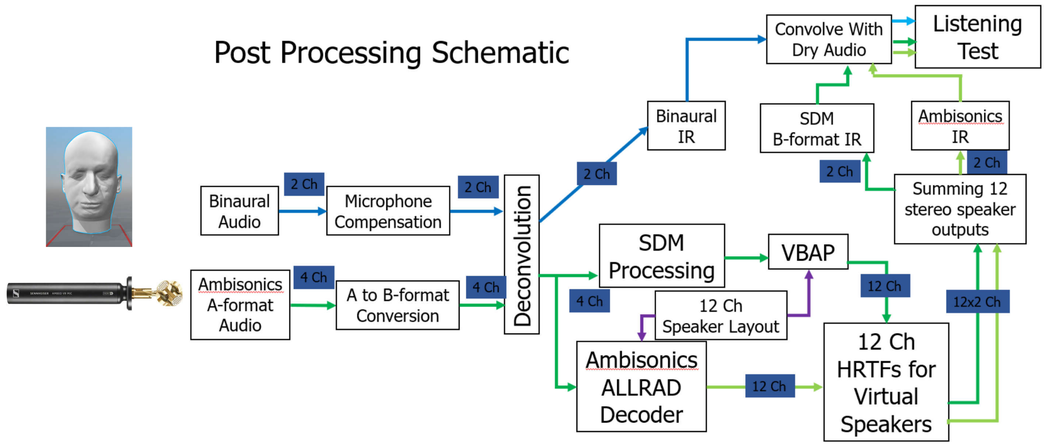


- Three speakers werre set up in an anechoic chamber to form three points in a cuboctahedron layout. Four rotations of the head gave 12 positions.



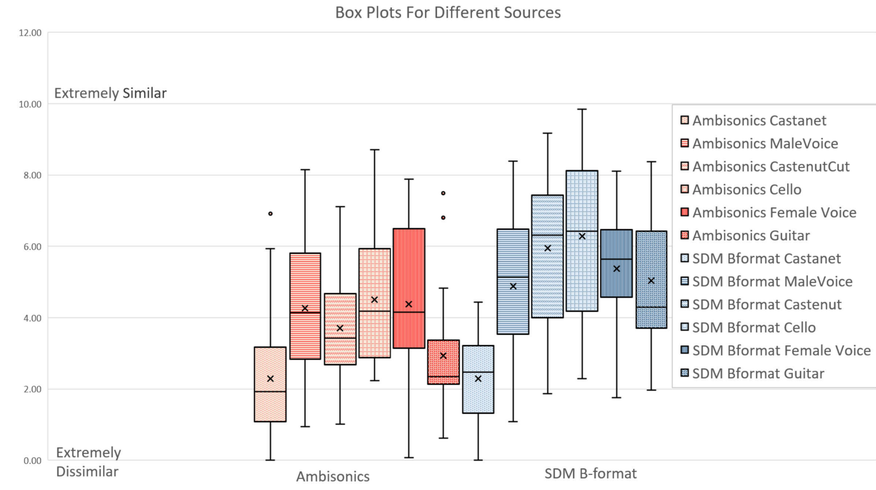
Methodology – Ambisonic Microphone Recording and Processing

- Measured A-format sweeps were converted to B-format impulses, which were then decoded using ALLRAD and SDM using B-format and routed to the cuboctahedron virtual speakers using VBAP. Binaural impulse responses were obtained using the measured HRTFs.



Results

- AB listening tests compared dummy-head recordings in different rooms (the references) with different audio samples to the "binaural" outputs rendered using ALLRAD + VBAP and SDM + VBAP.
- Samples using SDM + VBAP were found to be more similar to recorded binaural impulse responses than renderings made using ALLRAD + VBAP.



Presented at Euronoise 2018: the 11th European Congress and Exposition on Noise Control Engineering